






ORIGINAL ARTICLE



The predictors of proxy- and self-reported quality of life among individuals with acquired brain injury

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ABSTRACT

Purpose: Acquired brain injury (ABI) diminishes quality of life (QoL) of affected individuals and their families. Fortunately, new multidimensional instruments such as the *calidad de vida en daño cerebral* (CAVIDACE) scale are available. However, differences in self- and proxy-reported QoL remain unclear. Therefore, this study examined these differences and identified predictors of QoL among individuals with ABI.

Materials and methods: This cross-sectional study comprised 393 adults with ABI (men: 60%; $M_{\text{age}} = 54.65$, $SD = 14.51$). Self-, family-, and professional-reported QoL were assessed using the CAVIDACE scale. Other personal and social variables were assessed as predictors of QoL.

Results: Professionals had the lowest QoL scores ($M = 1.88$, $SD = 0.45$), followed by family members ($M = 2.02$, $SD = 0.44$) and individuals with ABI ($M = 2.10$, $SD = 0.43$). Significant differences were found for almost all QoL domains, finding the highest correlations between family and professional proxy measures ($r = 0.63$). Hierarchical regression analysis revealed that sociodemographic, clinical, rehabilitation, personal, and social variables were significant predictors of QoL.

Conclusions: It is necessary to use both self- and proxy-report measures of QoL. Additionally, the identification of the variables that impact QoL permits us to modify the interventions that are offered to these individuals accordingly.

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► IMPLICATIONS FOR REHABILITATION

- Acquired brain injury (ABI) causes significant levels of disability and affects several domains of functioning, which in turn can adversely affect quality of life (QoL).
- QoL is a multidimensional construct that is affected by numerous factors: sociodemographic, clinical, personal, social, etc; and also, with aspects related to the rehabilitation they receive after ABI.
- Rehabilitation programs should address the different domains of functioning that have been affected by ABI.
- Based on research findings about the QoL's predictors, modifications could be made in the rehabilitation process; paying special attention to the depressive- and anosognosia process, as well as the importance of promoting social support, community integration, and resilience.

Introduction

Acquired brain injury (ABI) is defined as damage to the brain that occurs after birth [1], which includes different diagnoses such as traumatic brain injury (TBI), cerebrovascular accident (CVA), brain tumor, anoxia, and infection. ABI can result in long-term disability, including physical, cognitive, emotional, and psychosocial impairments, limitations in activities of daily life, and restrictions in community participation [2]. Moreover, it can also result in inability to return to work and financial problems [3]. According to data released by the World Health Organization, ABI is the third leading cause of death and the most common cause of disability and dependency among adults [4]. Currently, more than 400 000 individuals in Spain have ABI [5]. Because moderate or severe ABIs often result in high disability, they have a significant impact on

quality of life (QoL) [6,7]. However, not all QoL domains appear to be affected in the same manner. The effect is more significant on domains that are related to autonomy and self-determination than on those related to emotions [8].

Currently, the QoL of individuals with ABI is primarily defined in terms of health-related outcomes (e.g., health-related QoL-HRQoL). However, this approach may result in the exclusion of other crucial domains of QoL (e.g., social inclusion, material well-being, rights, and personal development). Hence, there is a need for more comprehensive assessments of QoL that also measure contextual factors [9], such as the QoL model proposed by Schalock and Verdugo [10,11]. This model conceptualizes QoL as a multidimensional phenomenon composed of the following eight core domains: emotional well-being, physical well-being, material well-being, self-determination, interpersonal relationships,

Table 1. Sociodemographic-, clinical-, personal-, and social characteristics of the ABI sample ($N = 345$).

	Frequency (%)
Age (years) ($n = 341$)	
≤ 50	122 (35.8%)
> 50	219 (64.2%)
Educational level ($n = 324$)	
Without education/none	26 (8%)
Primary education	99 (30.6%)
Secondary education	102 (31.5%)
Higher education	97 (29.9%)
Type of home ($n = 217$)	
Independent flat	27 (12.4%)
Residential center	33 (15.2%)
Family home/sheltered flat	157 (72.4%)
Level support ($n = 316$)	
Intermittent	40 (12.7%)
Limited	34 (10.8%)
Extensive	85 (26.9%)
Generalized	157 (49.7%)
Degree of dependency ($n = 236$)	
Grade I moderate dependency	35 (14.8%)
Grade II severe dependency	94 (39.8%)
Grade III major dependency	107 (45.3%)
Time since injury (years) ($n = 319$)	
≤ 1.5	57 (17.9%)
2–4	94 (29.5%)
4.5–9.5	88 (27.6%)
≥ 10	80 (25.1%)
Location of the injury ($n = 312$)	
One hemisphere	219 (70.2%)
Both hemispheres	93 (29.8%)
Etiology of the injury ($n = 334$)	
Cerebrovascular accident	209 (62.6%)
Traumatic brain injury	77 (23.1%)
Cerebral anoxia	11 (3.3%)
Cerebral tumours	14 (4.2%)
Infection diseases	8 (2.4%)
Other	15 (4.5%)
Current health conditions	
Physical disability	298 (86.4%)
Cognitive deficit	272 (78.8%)
Sensory disability	173 (50.1%)
Language and communication	157 (45.5%)
Mental health problems/emotional disorder	110 (31.9%)
Behavioural problems	102 (29.6%)
Associated chronic pain	60 (15.4%)
Epilepsy	55 (15.9%)
Others	10 (2.9%)
Rehabilitation activities (number) ($n = 322$)	
≤ 5	104 (32.3%)
6–8	71 (22%)
9–11	86 (26.7%)
> 12	61 (18.9%)
Self-awareness ($n = 214$)	
Mean (SD)	10.32 (16.68)
Depression ($n = 320$)	
Mean (SD)	7.47 (5.90)
Resilience ($n = 302$)	
Mean (SD)	65.45 (17)
Social support ($n = 326$)	
Mean (SD)	2.10 (.98)
Satisfaction with social support ($n = 283$)	
Mean (SD)	5.07 (1.13)
Community integration ($n = 308$)	
Mean (SD)	9.56 (4.25)

social inclusion, personal development, and rights. These domains are universal constituents of the construct of QoL, but individuals differ in the value and importance that they ascribe to them. Furthermore, these domains are influenced by both personal characteristics and environmental factors. Thus, this conceptualization encompasses both objective (i.e., associated with observable indicators) and subjective (i.e., associated with the satisfaction

experience) components, which are assessed using culturally sensitive indicators [12,13].

In order to improve the QoL of individuals with ABI, it is important to use multidimensional assessments with good psychometric properties to identify the factors that positively and negatively affect QoL. Further knowledge of modifiable factors in particular may facilitate the development and implementation of targeted rehabilitation and support services for individuals with ABI.

Specialized multidimensional scales with self-report and proxy versions are currently available, such as the *calidad de vida en daño cerebral* (CAVIDACE; “quality of life in brain injury” in English), which has been developed based on the QoL model proposed by Schalock and Verdugo [14,15]. According to studies, it is important to use self-report measures, whenever possible, to more accurately determine QoL [16,17], allow individuals to express their needs, objectives, and desires [12], and provide professionals with valuable information for personal rehabilitation process [18]. However, the use of self-report measures on individuals with ABI should be pursued with caution and as a complement to proxy measures [19], because factors such as presence of anosognosia and other major cognitive problems could affect its results [20]. Furthermore, situations, such as global aphasia or state of minimal consciousness, render it practically impossible for the person with ABI to respond to self-report measures. Data from proxy reports should also be taken with caution since a majority of past studies have shown that there is no sufficiently relevant correlation between proxy reports and self-reports [20,21]. Moreover, higher levels of agreement have been found for domains that are related to activities of daily living and physical well-being, while greater discrepancies have been found for domains that pertain to social relationships and emotional well-being [21–23]. Finally, we have to consider that the use of each version has different objectives; self-reports are used for development of person-centered programs, while proxies are for program evaluation, improvement of quality of services, and evaluation of organizational services [17].

Past studies have identified the factors that affect QoL of individuals with ABI using measures of HRQoL [24–30]. These factors can be classified into sociodemographic characteristics, clinical variables, treatment modalities, personal factors, and social and familial factors.

Many sociodemographic characteristics, such as gender, age, educational level, and marital status can affect QoL. For example, some evidence suggest that women experience lower QoL levels than men [31,32], while other studies found no significant gender differences [24,33,34]. Moreover, QoL seems to decrease with age [24–26,34]; however, this is not absolute since some studies, such as the one conducted by Weber et al. [27], found that older adults reported better QoL. Similarly, those with higher educational level are found to report better QoL than those with lower educational level [24,28], but other studies have yielded inconsistent results [24,29,35]. Finally, marital status has also been found to affect QoL, whereby individuals with ABI who are married or in a relationship reported better QoL [33].

Many variables that are associated with ABI and its consequences, such as severity of ABI [32,34,36], degree of dependency [37,38], and somatic deficits [28] negatively affect QoL. Moreover, factors such as time since injury and rehabilitation process also influence QoL; however, pertinent studies have yielded contradictory results. For example, some studies have found that QoL improves over time [30,34], whereas others have shown the opposite [36,39]. Furthermore, cognitive rehabilitation processes

are known to improve QoL [40]. Lastly, other factors, such as ABI etiology (traumatic or non-traumatic), do not determine QoL levels [38,41].

Numerous personal variables such as depression [24,28,29,31,32,37,42–44] and anxiety [28,37,43] can negatively influence QoL. Therefore, personal protective factors, such as resilience [45] and adaptive coping styles (e.g., problem-solving and support-seeking behaviors), should be nurtured to improve QoL [7,46,47]. Other factors, such as lack of self-awareness or anosognosia, have also been found to have an effect on QoL, but the direction of this influence remains unclear. Formisano et al. [20] found that anosognosia is positively correlated with QoL, while other studies have shown the opposite: worse QoL is associated with higher levels of agnosognosia [42,47].

Insufficient social support after an ABI could adversely affect QoL [32,48]. Different studies have concluded that it is important to examine the contributions of social support, support satisfaction [35,46], level of participation, and community integration to QoL [24,37,38,49]. Moreover, employment has important positive effects on QoL [8,21,24,31] in relation to participation and community integration. In fact, past findings suggest that pre-ABI employment is also associated with better QoL after injury [8,50]. Despite this, the rate of return to employment of individuals with ABI in Spain is alarmingly low (i.e., approximately 20%) [3,51].

Given the importance of detailed assessment of QoL and examination of the factors that are likely to influence it for individuals with ABI, the following objectives of the present study were formulated:

1. To identify the factors that have the strongest relationship with QoL using a multidimensional model of the construct.
2. To analyze the possible sources of biases that can influence the measurement of QoL by examining differences in QoL across different reporters (i.e., professionals, family members, and individuals with ABI).

Materials and methods

Participants

Data were collected from a snowball sample of 393 individuals with ABI who were users of the services of 26 specialized centers in Spain. The inclusion criteria were as follows: (a) had experienced ABI; (b) is 16 years or older at the time of evaluation; (c) is currently being treated at a specific center for individuals with ABI, and (d) signed an informed consent form.

The participants' ages ranged between 18 and 91 years ($M = 54.83$, $SD = 14.91$), and more than half of the participants were men (61%). Moreover, more than half of the participants were married or cohabitating with a partner (52.8%), while the rest were either single, separated, or widow(er). They received attention in a day center (41.2%) or a rehabilitation center (58.8%). A majority of the participants (90%), including those who had been employed or studied before the injury (employment rate before ABI = 66%), were unemployed at the time of assessment (i.e., after injury). The main causes of ABI were CVA (62.6%) and TBI (23.1%), and the average time since injury was 7 years ($M = 7.28$, $SD = 7.03$, range = 0.5–47.5). A high percentage of ABI participants (37.4%) had more than five simultaneous health conditions. For more information, see Table 1.

Professionals, family members, and individuals with ABI responded to measures of QoL. In addition, individuals with ABI completed a series of complementary questionnaires that assessed emotional function, activities of daily living, and community participation. To be eligible for inclusion, the professionals

and family members had to have known the individual with ABI for extended periods of time (minimum of 3 months) and interacted with them across different contexts. Similar to individuals with ABI, the inclusion criteria was the ability to understand and respond to different questions. Using clinical criteria, the professionals determined whether a given individual with ABI would be able to participate in the study. The exclusion criteria were as follows: (a) was in a state of coma or had minimum consciousness, (b) had global aphasia, or (c) could not understand or answer most questions even with appropriate help. Only 345 of 393 potential participants with ABI were able to respond to self-report instruments. The proxy versions were administered to almost 500 informants (147 professionals and 343 family members). The professionals (women: 79%) were primarily neuropsychologists (24%), occupational therapists (20%), and physiotherapists (19%). About 76% said they had contact several times per week with the evaluated person, compared to 24% who saw the person only once a week or less. As for the family members, they were primarily partners (50%) and parents (28%), and distributed in the category of women (68%). Almost 95% saw their relatives several times per week.

Instruments

CAVIDACE scale

The CAVIDACE scale has been specifically designed to measure the QoL of adults with ABI using the responses of an external observer who knows the affected individual well [52]. It consists of 64 items that assess the eight domains (i.e., eight items per domain) that are subsumed by Schalock and Verdugo's QoL model [10,11]. Responses are recorded on a four-point frequency scale: 0 = *never*, 1 = *sometimes*, 2 = *frequently*, and 3 = *always*. The instrument includes negatively worded items, which were reversed before summing the scores for each domain. These direct scores are transformed into standard scores, which in turn can be used to generate a QoL profile, percentiles, and a global index. The scale also assesses a wide range of sociodemographic, clinical, and informant characteristics. It has demonstrated very good reliability and validity: QoL is composed of eight intercorrelated first-order domains ($CFI = 0.890$, $RMSEA = 0.065$, $SRMR = 0.071$). The internal consistency was good or excellent for the eight domains (ordinal alpha ranging from 0.77 to 0.93), while the inter-rater reliability was very high (0.97) [14].

The self-report version of the CAVIDACE scale is an adaptation of the original scale, and it is to be completed by individuals with ABI. It consists of 40 items that also assess the eight domains (i.e., five items per domain) of Schalock and Verdugo's QoL model using the same frequency rating scale [15]. It yields the same indexes and scores as the original scale. Its psychometric properties are good and comparable to those of the original scale: QoL is composed of eight first-order intercorrelated domains ($CFI = 0.891$, $RMSEA = 0.050$, $TLI = 0.881$), and the internal consistency was adequate in seven of the eight domains ($\omega = 0.66$ – 0.87) [15]. Both versions of the scale (in English) are included in Supplementary Appendix A.

Checklist of participation in rehabilitation activities

The Spanish Federation has developed a checklist that can be used to assess whether individuals with ABI participate in rehabilitation activities. This list assesses participation in activities that involve the following: general medicine and nursing, physical medicine and rehabilitation, legal advice, psychological/psychiatric care, speech and communication rehabilitation, cognitive and

behavioral rehabilitation, community integration activities, leisure activities, vocational training, training programs on the basic and instrumental activities of daily living, home help service, animal therapy, dining, sports and physical activity, occupational workshops, adapted transportation, and support services for family members. Individuals with ABI are required to indicate whether they have participated in each of these activities. One point was given for each activity participated, obtaining an index that ranged from 0 to 17 points. Those who provided affirmative responses are required to indicate the center in which they had participated, the number of weekly hours spent, and the specific activities that they had undertaken.

Patient health questionnaire

The Patient Health Questionnaire (PHQ-9), which consists of 9 items, assesses depression in accordance with the Diagnostic and Statistical Manual of Mental Disorders, Fourth (DSM-IV) criteria [53]. Total scores ranged from 0 to 27, with higher scores indicating more severe depression. The PHQ-9 has been validated among individuals with ABI [54] and within Spanish samples [55]; it has demonstrated good psychometric properties across both samples. This questionnaire assesses depression according to the updated DSM-V criteria [56].

Patient competency rating scale

The original version of the Patient Competency Rating Scale (PCRS), which was published in 1986, consists of 30 items that assess the competency to perform different daily life tasks [57]. Individuals with ABI are required to indicate the extent to which it is difficult for them to perform the task that has been described in each item. Their responses can be compared to those of a family member or professional. In this study, we compared the responses of individuals with ABI and professionals. Wider discrepancies between the two sets of responses indicate poor self-awareness. Specifically, the total scores of discrepancy can be interpreted as follows: $< 28 = \text{low lack of self-awareness}$, $28-51 = \text{moderate lack of self-awareness}$, and $> 51 = \text{severe lack of self-awareness}$ [57]. Both the Spanish [58] and English [57] versions of this scale have strong psychometric properties.

Community integration questionnaire

The Community Integration Questionnaire is a 15-item measure of perceived community integration of individuals with ABI [59]. Total scores ranged from 0 to 29. It consists of three domains: home integration, social integration, and productive activities. Higher scores indicate greater integration and fewer restrictions on participation. Good psychometric properties have been demonstrated by its Spanish version [60]. Sander et al. [61] revised this assessment by eliminating two items (i.e., items 4 and 10) with ambiguous meanings; we used this shortened version in this study.

Connor-Davidson resilience scale

The Connor-Davidson Resilience Scale is a 25-item measure of resilience [62] that has been used to assess samples with a wide range of conditions, including ABI [63]. Total scores, which can be calculated by summing the individual items, can range from 0 to 100, with higher scores indicating greater resilience. This assessment has demonstrated excellent psychometric properties [62].

Social support questionnaire-6

The Social Support Questionnaire-6 (SSQ6) is an abbreviated version of the Social Support Questionnaire [64]. Individuals with ABI

are required to respond to each item by (a) indicating the number of individuals who are available to provide them with support across six areas and (b) rate their level of social support satisfaction. SSQ6 has been used with individuals with ABI and has generally demonstrated good psychometric properties [65]. Social support and social support satisfaction scores ranged from 0 to 6 and 1 to 6, respectively.

Procedure

Professionals and participating centers were primarily recruited through emails and telephone calls. First, we contacted the centers that had participated in the study in which the CAVIDACE scale was constructed and validated. On numerous occasions, these professionals facilitated liaisons with other centers, thereby resulting in snowball sampling. Second, in order to recruit a larger sample, information about the study was (a) disseminated through conferences and (b) posted on the university's website.

Once a center expressed interest in participating in the study, one member of the research team visited the collaborating center and provided them with all the necessary information about the study (e.g., instruction manual, detailed explanation of the study, and characteristics of the theoretical model of QoL). In each center, a research assistant was trained to oversee the administration of the CAVIDACE scale and other complementary tests. In order to participate in the study, participants had to meet the established inclusion criteria, and when the number of participants exceeded the possibilities of participation of the center, it was the research assistant who randomly selected participants. All the participating centers were informed that participants could complete either an online or paper-and-pencil version of the assessments. Based on considerations of the limitations of individuals with ABI and their family members, all the centers opted for the pen-and-paper version of the assessments ($n = 26$). Accordingly, printed copies of the assessments were sent to participating centers.

Subsequently, the research assistants contacted individuals with ABI and their family members to inform them about the study, obtain their informed consent, and send them the scales that they were required to complete. Once this process had been completed, they were required to return the documents to the research team. We maintained regular contact with them through email and telephone calls to communicate important information and clarify any questions. This phase of data collection spanned from November 2017 to November 2018.

This study was approved by the Bioethics Committee of the University of Salamanca (No: 20189990014185/Record: 2018/REGSAL-1931). Written informed consent was obtained from both participants with ABI and their family members. With regard to legally incapacitated individuals, informed consent was obtained from their legal representatives. Personal and clinical data were collected, stored, and protected in accordance with the Organic Law 15/1999 of 23 December on the Protection of Personal Data to maintain confidentiality and the anonymity of the participants.

Statistical analyses

The domain scores of the proxy and self-report versions of the CAVIDACE scale ranged from 0 to 24 and 0 to 15, respectively. We used the mean scores of the items of each domain and all the items to arrive at the total score, which we then used to compare the different versions of the scale.

We conducted bivariate correlational analysis (i.e., Pearson's correlation in the continuous and categorical dichotomous

Table 2. Descriptive statistics of QoL by domains and by respondents.

Domains	Professional (<i>n</i> = 389) <i>M</i> (<i>SD</i>)	Family member (<i>n</i> = 353) <i>M</i> (<i>SD</i>)	ABI's person (<i>n</i> = 340) <i>M</i> (<i>SD</i>)
Emotional well-being	1.90 (0.54)	1.96 (0.54)	2.11 (0.61)
Interpersonal relationships	1.68 (0.65)	1.90 (0.70)	2.03 (0.74)
Material well-being	2.32 (0.57)	2.54 (0.50)	2.41 (0.60)
Personal development	1.42 (0.63)	1.61 (0.65)	1.84 (0.65)
Physical well-being	2.06 (0.52)	2.18 (0.54)	2.14 (0.62)
Self-determination	1.78 (0.82)	1.85 (0.80)	2.02 (0.75)
Social inclusion	1.60 (0.70)	1.68 (0.75)	1.74 (0.81)
Rights	2.29 (0.54)	2.45 (0.46)	2.43 (0.52)
Total	1.88 (0.45)	2.02 (0.44)	2.10 (0.43)

variables and Spearman's in the ordinal variables) to examine the relationships between the total QoL and domain scores of the professionals, individuals with ABI, and their family members, including the other aforementioned variables. In the case of nominal categorical variables with more than two levels (i.e., type of home), ANOVA and Tukey's *post-hoc* tests were performed. The study variables were classified into five categories: sociodemographic, clinical, rehabilitation, personal, and social variables.

To identify the predictive impact on the dependent variables (i.e., total QoL and eight domain scores for the three groups of reporters: professionals, individuals with ABI, and family members), 27 hierarchical multiple regression analyses were conducted with the following five groups of independent variables: step 1 = sociodemographic (i.e., age, gender, civil status, educational level, prior employment status, type of home, and type of center attention), step 2 = clinical (i.e., level of support, degree of dependency, time since injury, location and etiology of the injury, and comorbidity, which was defined as the number of health conditions), step 3 = rehabilitation (i.e., number of activities), step 4 = personal (i.e., self-awareness, depression, and resilience), and step 5 = social (i.e., social support, social support satisfaction, and community integration). Variables that cannot be modified were introduced in the sociodemographic and clinical groups, while those that can be intervened were introduced in the rehabilitation, personal, and social groups. The variables of each group that were significant in the bivariable correlation analysis were included in the initial model (i.e., the enter method). Factors with a $p < 0.10$ were retained. Once potential predictors were identified, the model was built using the forward method [41]. All the variables fulfilled the assumptions of homoscedasticity, normality, and multicollinearity ($rs < 0.70$) across all the 27 models. A summary of the results of all models is presented as R^2 adjusted. R^2 was interpreted according to Cohen's (1988) guidelines (i.e., 0.02 = small; 0.13 = medium; 0.26 = large) [66]. We selected those regression models with large values of R^2 ($R^2 > 0.26$), with the exception of the total professional score, which, despite having a value of 0.25, were also selected given its interest. The variables of the last step of these models were included, represented by the standardized beta values, the change in adjusted R^2 values in each step, and the total adjusted R^2 .

We examined the level of agreement between professional-, self-, and family reported QoL. Accordingly, we conducted bivariate correlational analysis to examine the relationships between the two sets of total QoL and domain scores and one-way between-groups ANOVA. The assumptions of normality and homoscedasticity were verified. In case of a significant result, Tukey's *post-hoc* test was used to explore which means differed. Effect sizes were analyzed using eta-squared (η^2).

All the data were analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0, and the results were

considered significant if the p -value was < 0.01 . Bonferroni adjustment was used in the corresponding analyses.

Results

The total QoL scores were normally distributed. The range of scores was 0.61–2.95 among professionals ($M_{\text{professional}} = 1.88$, $SD = 0.45$), 0.70–2.93 among family members ($M_{\text{family}} = 2.02$, $SD = 0.44$), and 0.77–2.95 among individuals with ABI ($M_{\text{ABI}} = 2.10$, $SD = 0.43$). The domains with the highest means were material well-being (range 2.32–2.54 between reporters) and rights (range 2.29–2.45), whereas the lowest means were for personal development (range 1.42–1.84) and social inclusion (range 1.60–1.74). These descriptive results are presented in Table 2.

Group comparisons revealed that the lowest QoL scores were obtained by professionals, followed by family members. This was the case for both the total and all domain scores, except material well-being, physical well-being, and rights; in these domains, the highest scores were for family members.

Factors related to QoL: correlational analyses

Table 3 presents the correlations that appeared between the study variables and the three sets of QoL scores (i.e., those of professionals, family members, and individuals with ABI). With regard to sociodemographic variables, positive correlation coefficients were found for educational level and type of center, while negative correlation coefficients appeared for age, civil status, prior employment, and type of home. Among the clinical variables, level of support, degree of dependency, time since injury, location of the injury, and comorbidity were negatively correlated with QoL, whereas the etiology of the injury was positively related to it. The number of rehabilitation activities that individuals with ABI had participated in was negatively correlated with QoL. With regard to personal variables, negative correlation coefficients were found for self-awareness and depression, while positive correlation coefficients appeared for resilience. Finally, all the social variables (i.e., social support, social support satisfaction, and community integration) were positively correlated with QoL. Thus, a higher level of QoL appeared for individuals with ABI with the following characteristics: younger, married or cohabitating with a partner, with a higher educational level, employed or students before the injury, received treatment at a rehabilitation center, with fewer support needs, a low dependency level, a recent and non-traumatic ABI, lesion located in a single cerebral hemisphere, and low comorbidity; participation in fewer rehabilitation activities; low levels of depression, and anosognosia; and high levels of resilience, social support, social support satisfaction, and community integration. Finally, with respect to gender differences, different patterns of results were found across the different

Table 3. Correlations for the variables predicting QoL for professionals, family members and ABI's persons.

Predictors	Respondent	Domains								
		Emotional well-being	Interpersonal relationships	Material well-being	Personal development	Physical well-being	Self-determination	Social Inclusion	Rights	Total
Sociodemographic variables										
Age (years)	Professional			-0.18**						
1: ≤50	ABI's person							-0.15**		
2: >50	Family							-0.16**		
Gender	Professional									
1: Female	ABI's person	-0.16**								
2: Male	Family									
Civil status	Professional				-0.16**					
1: Married/cohabitating	ABI's person									
2: Single/separated/divorced/widow(er)	Family									
Educational level	Professional		0.15**	0.20***			0.19***	0.19***	0.15**	0.20***
1: Without education/none	ABI's person		0.18**				0.20***			
2: Primary education	Family							0.17**		
3: Secondary education										
4: Higher education										
Prior employment status	Professional			-0.14**						
1: Employed/student	ABI's person			-0.19**				-0.19**		-0.18**
2: Not active/unemployed	Family			-0.16**				-0.14**		
Type of center	Professional	0.19**	0.34***	0.25***	0.37***		0.45***	0.18**	0.33***	0.38***
1: Day center	ABI's person		0.20**	0.13**			0.17**			
2: Rehabilitation center	Family	0.26***	0.28**	0.19**	0.38***		0.41***		0.22***	0.35***
Clinical variables										
Level of support	Professional				-0.26***		-0.29***		-0.22***	-0.23***
1: Intermittent	ABI's person				-0.21***		-0.15**			
2: Limited	Family				-0.23***		-0.25***			-0.16**
3: Extensive										
4: Pervasive										
Degree of dependency	Professional	-0.19**	-0.19**	-0.16**	-0.32***		-0.34***	-0.22***	-0.23***	-0.30***
1: Grade I moderate dependency	ABI's person						-0.27***			
2: Grade II severe dependency	Family			-0.18**	-0.27***	0.19**	-0.31**	-0.17**	-0.16**	-0.21**
3: Grade III major dependency					-0.21***		-0.24***		-0.17**	-0.17**
Time since injury (years)	Professional		-0.18***				-0.16**			
1: ≤1.5	ABI's person		-0.18**				-0.16**			
2: 2-4	Family	-0.15**	-0.19**		-0.23***		-0.26***			-0.18**
3: 4.5-9.5										
4: ≥10										
Location of the injury	Professional		-0.14**		-0.22***		-0.28***			-0.20***
1: One hemisphere	ABI's person									
2: Both hemispheres	Family		-0.19**		-0.17**	0.16**	-0.24***			-0.15**
Etiology of the injury	Professional				0.15**		0.18***			
1: Traumatic	ABI's person				0.		0.17**			
2: Non traumatic	Family	0.15**	-0.20***		-0.25***		-0.27***	-0.18***		-0.23***
Comorbidity	Professional	-0.18**	-0.15**		-0.20***		-0.20***			-0.20**
1: ≤5	ABI's person				-0.26***		-0.21**	-0.14**		-0.19***
2: >5	Family	-0.14**								
Rehabilitation variables										
Activities (number)	Professional				-0.23***		-0.25***			-0.17**
1: ≤5	ABI's person						-0.20***			
2: 6-8	Family	-0.15**			-0.25***		-0.20**			-0.18**
3: 9-11										
4: >12										
Personal variables										
Self-awareness	Professional	-0.19**	-0.20**		-0.21***		0.24***		-0.22**	-0.23***
ABI's person							-0.18**			
Family										
Depression	Professional	-0.27***	-0.19**		-0.22***			-0.15**		-0.19***
ABI's person		-0.43***	-0.24***					-0.16**		-0.28***
Family		-0.18**	-0.15**					-0.16**		-0.16**
Resilience	Professional	0.28***	0.18**	0.15**	0.23***	0.15**	0.21***	0.23***		0.28***
ABI's person		0.36***	0.23***		0.41***	0.18**	0.24***	0.26***	0.17**	0.39***
Family		0.21***	0.26***		0.25***		0.27***	0.27***	0.18**	0.31***
Social variables										
Social support	Professional		0.20***				0.14**	0.22***		0.18**
ABI's person			0.29***	0.23***	0.15**			0.21***		0.24***
Family			0.23**	0.24**				0.18**	0.20***	0.24***
Satisfaction with social support	Professional	0.18**	0.21***		0.17**	0.21**		0.19**		0.20***
ABI's person			0.32***	0.25***	0.17**			0.17**	0.28***	0.33***
Family		0.19**	0.22***	0.23**				0.20**		0.25***
Community integration	Professional	0.17**	0.32***	0.17**	0.35***		0.46***	0.35***	0.29***	0.39***
ABI's person			0.36***	0.24***	0.33***		0.41***	0.28***		0.39***
Family			0.25***	0.21***	0.32***		0.37***	0.26***	0.29***	0.32***

** $p < 0.01$, *** $p < 0.001$.

Table 4. Hierarchical regression analysis of variables predicting QoL for the three respondents (resume of R^2 adjusted scores).

Respondent	Dependent variable								
	Emotional well-being	Interpersonal relationships	Material well-being	Personal development	Physical well-being	Self-determination	Social inclusion	Rights	Total
Professional	0.18***	0.21***	0.12***	0.38***	0.03**	0.40***	0.15***	0.22***	0.25***
ABI's person	0.23***	0.32***	0.17***	0.33***	0.07***	0.29***	0.14***	0.11***	0.33***
Family member	0.18***	0.22***	0.06**	0.28***	0.04**	0.34***	0.12***	0.13***	0.28***

Total R^2 adjusted scores are presented.

** $p < 0.01$, *** $p < 0.001$.

domains. Specifically, in emotional well-being and material well-being, men obtained lower QoL scores than women. However, men obtained higher scores in self-determination than women.

For the variable type home, we found significant results in the proxy reports (i.e., professional and family) for personal development ($F_{2,237} = 12.51, p < 0.001, \eta^2 = 0.10$; $F_{2,220} = 11.48, p < 0.001, \eta^2 = 0.09$, respectively) and self-determination domain ($F_{2,236} = 15.83, p < 0.001, \eta^2 = 0.12$; $F_{2,219} = 14.50, p < 0.001, \eta^2 = 0.12$, respectively). In all cases, *post-hoc* tests showed significantly better QoL levels in the group living in an independent flat compared to those living in a residential center or with their families.

Predictors of QoL: multivariate analysis

Twenty-seven hierarchical multiple linear regression models were analyzed to identify the predictors of self-, professional-, and family-reported QoL (i.e., total and domain scores) and ascertain the percentage of variance in QoL that are attributable to the predictors. The results of the regression analyses are presented in Table 4.

The adjusted R^2 values, expressed as percentages, for the predictors of total QoL scores were 25% (professionals), 33% (individuals with ABI), and 28% (family members). Analysis of the responses provided by professionals revealed that one sociodemographic variable (i.e., type of center; $\beta = 0.31, p < 0.001$) and another clinical (i.e., dependency level; $\beta = -0.26, p < 0.001$) variable, as well as two social factors (i.e., community integration; $\beta = 0.16, p = 0.020$ and social support satisfaction; $\beta = 0.15, p = 0.031$) were the main predictors of total QoL scores. Analysis of the responses that had been provided by individuals with ABI revealed that resilience ($\beta = 0.22, p < 0.001$), depression ($\beta = -0.13, p = 0.035$), community integration ($\beta = 0.28, p < 0.001$), and social support satisfaction ($\beta = 0.28, p < 0.001$) were the most important predictors of QoL. Finally, analysis of the data that were collected from family members revealed that QoL was predicted by five variables: type of center ($\beta = 0.24, p < 0.001$), number of rehabilitation activities ($\beta = -0.20, p = 0.002$), resilience ($\beta = 0.27, p < 0.001$), social support ($\beta = 0.15, p = 0.017$), and social support satisfaction ($\beta = 0.14, p = 0.025$).

The highest and significantly adjusted R^2 values were found for the domains of self-determination and personal development ($R^2 > 0.26$), while the lowest was for physical well-being ($R^2 < 0.10$). Complete hierarchical regression models of dependent variables with large R^2 values are shown in Table 5. High adjusted R^2 values appeared in community integration (i.e., social variables) for the self-determination domain across all the three groups of reporters: professionals ($\beta = 0.30, p < 0.001$), individuals with ABI ($\beta = 0.30, p < 0.001$), and family members ($\beta = 0.26, p < 0.001$). The type of center was the only significant factor in sociodemographic variables for professional- and family-reported self-determination ($\beta = 0.32, p < 0.001$; $\beta = 0.30, p < 0.001$, respectively). Clinical variables were important explanatory variables for professional- and family-reported self-determination, specifically, the location of the

injury ($\beta = -0.22, p < 0.001$; $\beta = -0.17, p = 0.005$, respectively) and support level ($\beta = -0.20, p < 0.001$; $\beta = -0.18, p = 0.002$, respectively). Similarly, dependency and time since injury were significant predictors of self-reported self-determination among individuals with ABI ($\beta = -0.25, p < 0.001$; $\beta = -0.14, p = 0.029$, respectively). Finally, silence (i.e., personal variables) predicted family- and self-reported self-determination ($\beta = 0.14, p = 0.019$; $\beta = 0.16, p = 0.020$, respectively).

Regarding personal development, one of the most important groups of predictors was clinical and sociodemographic variables. In the first group, support level ($\beta = -0.25, p < 0.001$; $\beta = -0.16, p = 0.005$) predicted professional- and self-reported, respectively, and comorbidity ($\beta = -0.18, p = 0.002$; $\beta = -0.23, p = 0.022$) predicted professional- and family reported, respectively. In sociodemographic variables, we again found that the most significant predictor was type of center. Other significant predictors were community integration (i.e., social variables) for professional, self-, and family reported personal development ($\beta = 0.19, p = 0.012$; $\beta = 0.21, p < 0.001$; $\beta = 0.18, p = 0.002$, respectively). However, resilience (i.e., personal variables) was the main predictor ($\beta = 0.33, p < 0.001$) of self-reported personal development and an important factor in the family reported evaluation ($\beta = 0.19, p = 0.001$).

CAVIDACE scale scores: differences between participants

Table 6 presents the correlations that were found among professional-, family-, and self-reported QoL; there were significant correlations between all pairs of scores. The strongest correlations were between professional- and family reported self-determination ($r = 0.77$) and personal development ($r = 0.64$), while the weakest correlation was between professional- and self-reported rights ($r = 0.29$) and family- and self-reported rights ($r = 0.17$). With regard to total scores, the higher correlation that appeared between professional and family member QoL ($r = 0.63$) was stronger than the correlation between professional- and self-reported QoL ($r = 0.52$) and between family- and self-reported QoL ($r = 0.50$).

We found significant differences in professional-, family-, and self-reported emotional well-being (between professionals and individuals with ABI, and between family members and individuals with ABI), interpersonal relationships (between professionals and family members, and between professionals and individuals with ABI), material well-being (between professionals and family members, and between family members and individuals with ABI), personal development (all comparisons), self-determination (between professionals and individuals with ABI), rights (between professionals and family members), and total QoL (between professionals and family members, and between professionals and individuals with ABI). Table 7 shows the results of ANOVA with Bonferroni adjustment, η^2 values, and *post-hoc* analyses.

Table 5. Hierarchical regression analysis of variables predicting QoL: Coefficients of the factors included in the final models (only dependent variables with R² adjusted scores >0.26).

Dependent variable	Interpersonal relationships						Personal development						Self-determination						Total							
	ABI's person		Professional		Family		ABI's person		Professional		Family		ABI's person		Professional		Family		ABI's person		Professional		Family			
Predictor (Independent variable)	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β	R ²		
<i>Step 1: Sociodemographic variables</i>																										
Educational level	0.154*	0.09		0.27		0.13		0.19		0.15		0.13		0.13		0.15		0.13		0.13		0.13		ns	ns	0.11
Type of home			-0.198**																							
Centre attention			0.315***		0.340***		0.319***		0.296***		0.311***		0.237***													
<i>Step 2: Clinical variables</i>																										
Level of support		ns		0.08		0.07		0.13		0.08		0.07		0.08		0.07		0.07		0.07		0.07		ns	ns	ns
Degree of dependence			-0.245**		-0.157**		-0.196***		-0.177**		-0.252***		-0.258***													
Time since injury																										
Location of the injury			-0.168*				-0.216***		-0.167***																	
Comorbidity							-0.179**																			
<i>Step 3: Rehabilitation variables</i>																										
Activities		ns		ns		ns		ns		ns		0.03		ns		ns		ns		ns		ns		ns	0.02	
<i>Step 4: Personal variables</i>																										
Depression	-0.164**	0.10		ns		0.05		ns		0.04		0.05		0.04		0.04		ns		ns		0.18		0.11	0.11	
Resilience	0.066			-0.130*		0.329***		0.189**		0.143*		0.155*		0.223***		0.267***		-0.127*		0.223***		0.267***		0.267***	0.267***	
<i>Step 5: Social variables</i>																										
Social support		0.13		0.03		0.10		0.08		0.07		0.08		0.07		0.05		0.05		0.15		0.15		0.15	0.04	
Satisfaction with social support	0.287***																								0.149*	
Community integration	0.264***		0.191*		0.184**		0.304***		0.256***		0.144*		0.302***		0.159*		0.278***		0.279***		0.278***		0.279***		0.142*	
<i>Total R² adjusted</i>		0.32		0.38		0.33		0.40		0.34		0.29		0.34		0.25		0.25		0.33		0.33		0.33	0.28	

Change in R² adjusted scores for the final model are presented; β = Beta coefficient standardized.

*p < 0.05, **p < 0.01, ***p < 0.001.

Table 6. Correlations in the different domains by respondents.

Domains	Professional-Family member	Professional- ABIs	Family member-ABIs
Emotional well-being	0.53***	0.48***	0.37***
Interpersonal relationships	0.52***	0.48***	0.49***
Material well-being	0.46***	0.36***	0.29***
Personal development	0.64***	0.44***	0.43***
Physical well-being	0.29***	0.30***	0.36***
Self-determination	0.77***	0.58***	0.59***
Social inclusion	0.48***	0.49***	0.39***
Rights	0.37***	0.29***	0.17**
Total	0.63***	0.52***	0.50***

****p* < 0.001.

Table 7. ANOVA, η^2 , and Tukey *post-hoc* test for the evaluations of QoL's levels.

Domain	Sig	η^2	<i>Post-hoc</i>	Sig
Emotional well-being	<0.001	0.055	Professional – ABI's person Family member- ABI's person	<0.001 0.001
Interpersonal Relationships	<0.001	0.086	Professional- Family member Professional- ABI's person	<0.001 <0.001
Material well-being	<0.001	0.064	Professional- Family member Family member- ABI's person	<0.001 <0.001
Personal development	<0.001	0.148	Professional- Family member Professional – ABI's person Family member- ABI's person	<0.001 <0.001 <0.001
Physical well-being	ns	0.016		
Self-determination	0.001	0.021	Professional- ABI's person	0.003
Social Inclusion	ns	0.005		
Rights	0.001	0.031	Professional- Family member	<0.001
Total	<0.001	0.086	Professional- Family member Professional – ABI's person	<0.001 <0.001

Discussion

In this study, the self-report and proxy versions of the newly developed CAVIDACE scale were used to measure the QoL of a large sample of adults with ABI. Individuals with ABI, family members, and professionals completed the assessments. We analyzed the differences in the responses that were provided by the three groups to identify possible sources of measurement bias. We also explored the associations between QoL and different factors that are likely to influence QoL and identified the predictors of QoL among the three groups of participants.

The descriptive results by domains showed that rights and material well-being had the highest values, while personal development and social inclusion had the lowest values. These results are consistent with past findings that have been reported for individuals with ABI [41], and similar to those obtained using samples of individuals with other conditions [67]. These results underscore the importance of promoting community integration and cognitive abilities among individuals with ABI.

The indices that regression analysis yielded tended to be higher for self-reported QoL. The fact that complementary tests are completed by individuals with ABI may favor the best results found in the regression analyses. In addition, strong predictive relationships were found for specific domains (e.g., self-determination and personal development), while weak predictive relationships were found for other domains (e.g., physical well-being), irrespective of whether professional-, self-, or family- reported QoL were analyzed. The strongest and weakest predictive relationships that were identified through regression analysis in the different domains corresponded to the highest and lowest omega coefficients in the validation study. This applies to both versions of the CAVIDACE scale [14,15] for the different respondents. Therefore, the weak predictive relationships that appeared for the physical well-being domain may be attributable to the poor functioning of

the corresponding scale items. Another possible explanation pertains to the fact that the variables examined in this study were more closely related to psychosocial processes than to physical ones.

Past findings have yielded contradictory findings about the effects of sociodemographic variables on QoL. Nevertheless, they had important effects on the QoL of individuals with ABI in this study. These findings have practical implications because they can be used to target rehabilitation interventions for those who are likely to experience worse outcomes. In fact, statistically significant differences were found for several sociodemographic variables. Moreover, the effects of the following factors are particularly noteworthy: educational level and the type of center where people with ABI received attention. First, a higher educational level was associated with better QoL, and this finding may be attributable to greater opportunities for employment and economic resources that are afforded by a higher educational level [21,24,28,41]; however, there is a lack of consensus about the relationship between educational level and QoL [29,35]. Similarly, employment prior to injury was a significant predictor of better QoL after injury [41]. Second, individuals with ABI who were being treated at a rehabilitation center reported better QoL than those who were being treated at a day center. This may be the case because rehabilitation centers offer access to a wider range of personal and material resources. Furthermore, the range of disability and dependency levels tends to be wider (including mild levels) among those who are treated at rehabilitation centers than among those who are treated at day centers (who typically have more severe ABI). With regard to gender, inconsistent findings appeared for different domains; across a majority of the domains, QoL was higher among men [31], but on some domains (e.g., self-determination), women obtained higher scores.

Some clinical variables (e.g., dependency level, support needs, time since injury, location of the injury, and comorbidity) were statistically significant predictors of QoL. On the one hand, ABIs that entail a higher degree of dependency and more support needs [41,68] were associated with poor QoL. Decision-making abilities, the capacity to act independently, and participation in inclusive settings tended to be poorer among individuals with ABI who had high dependency levels. On the other hand, individuals for whom the time since injury was longer reported poorer QoL than those who had sustained an injury recently [36,39,41]; however, the results of some studies are indicative of an opposite trend [34]. Factors such as the stabilization of symptoms or aging may have influenced our results. Those with bilateral brain involvement have been found to report poorer QoL than those with only a unilateral lesion [41], which correlates directly with greater quantity and severity of the ABI's sequelae. Fourth, a higher number of moderately severe symptoms (comorbidities) after an ABI was associated with poor QoL [69]. Clinical factors, such as the etiology of ABI, have shown little significant effect on

QoL. This result can be explained by the fact that a large part of the sample was in a subacute or chronic phase of the disease, in which (at least in Spain) the rehabilitation process is usually carried out jointly for the different etiologies.

The number of rehabilitation activities in which individuals with ABI participated significantly predicted family reported QoL and some of its domains. Specifically, participation in a higher number of activities may have been related to poor QoL because it is related to greater support needs [70]. Future studies should examine how temporal changes in participation in rehabilitation activities impact QoL.

Finally, almost all the personal and social variables had significant effects on self-, family-, and professional-reported QoL and most domain scores. The effects of resilience, social support satisfaction, and community integration are particularly noteworthy. In this study, depressive symptoms were negatively associated with QoL [24,28,29], whereas resilience exerted the opposite effect [45]; these findings are consistent with those of several previous studies. However, the effect of a lack of self-awareness on QoL could not be clearly established. Although it was significantly related to some domain scores that were computed using professional- and family reported data, no significant effect appeared for self-reported QoL. It appears that higher levels of anosognosia are associated with lower QoL [42,47]. Although there are many cases of overestimation in the self-awareness test, PCRS, which could affect the results. Overestimation means that the person with ABI believes that he/she is able to carry out fewer tasks than he/she is capable of doing, according to the objective evaluator. Also, it had been found a ceiling effect in this instrument [71]. With regard to social variables, social support and satisfaction with social support had a positive effect on QoL, and the latter was a significant predictor more frequently than the former. Accordingly, several authors have underscored the importance of the subjective aspects of social participation (i.e., satisfaction) [17,44]. Such a contention is contrary to Siebens et al.'s [16] ascription of greater importance to the number of social activities in which one participates and frequency of participation. Finally, the positive influence of community integration, which is closely related to participation in productive activities (e.g., return to work and social participation), on QoL is noteworthy [37,38].

In summary, although many of the variables impacted QoL outcomes, there were five that should be highlighted because of their notable weight as QoL predictors for individuals with ABI. In this sense, receiving attention in a day center, having a greater degree of dependency, being less resilient, having worse community integration, and being less satisfied with social support were significant predictors of worse QoL. It is striking that in our study, although depression has a significant negative effect on QoL, it is not among the most important predictors, at least as regards proxy respondents. This could be an indicator of the insufficient capacity to detect depressive symptoms in professionals and family members. All these aspects should be considered when providing support and services aimed at improving the lives of people with ABI.

Total QoL and domain scores were higher when self-reported data were analyzed as compared to professional- or family-reported data. This finding concurs with those of other studies that have assessed the QoL of individuals with ABI [20,22,23,72]. Family- reported QoL was higher only for three domains: interpersonal relationships, physical well-being, and rights. However, professionals always obtained lower scores than the other two groups. It appears that professionals used stricter criteria when they assessed the QoL of individuals with ABI. One possible

explanation could be their in-depth knowledge of all the deficits of the affected individuals. In a study conducted among individuals with intellectual disability, differences in professional-, family-, and self-reported QoL (i.e., Schalock and Verdugo's model) were examined using the INICO-FEAPS (Comprehensive Quality of Life Assessment of people with intellectual and developmental disabilities). Accordingly, significant differences were found between the three sets of scores; the highest scores appeared for self-reported QoL, followed by family- and professional-reported QoL [73]. These findings are consistent with the differences analyzed in the present study.

Analysis of the responses of the three groups of participants revealed that there were significant differences between total QoL and all domains except physical well-being [19] and social inclusion. The differences found were also lower in other domains (e.g., as self-determination), which may be attributable to the fact that the items in this domain assess observable behaviors [22,23]. In contrast to other domains (e.g., personal development). Informants' reports on QoL of individuals with ABI may largely be dependent on their verbal and behavioral responses. For items regarding other domains, individuals with ABI may conceal the challenges they experience from their informants. This would explain the higher correlations between both proxy reports when we compared the self-report evaluation with those by family members and professionals. Thus, informants may overreport or underreport the challenges faced by individuals with ABI, thereby diminishing the validity of the findings. Moreover, better ecological validity has been reported as a strength when using self-report measures [74]. However, given the cognitive deficits and anosognosia process [20] of individuals with ABI, it is important to complement self-report measures with family- and professional-reports (proxy measures).

This study had several strengths. First, the use of both self- and proxy-report measures allowed us to examine the complex trends that underlie the measurement of QoL. Second, we examined the relationships between a wide range of variables (i.e., sociodemographic, clinical, personal, and social variables) of QoL using specific instruments [14,15,52] that have previously been validated by individuals with ABI. Finally and most noteworthy, we examined the rehabilitation activities undertaken by individuals with ABI. The findings can be used to identify targets for intervention models and provide valuable help to professionals who attend to them, thereby directly improving the QoL of affected individuals.

However, this study had some limitations. First, since we used a cross-sectional research design, the causal links between the examined predictors and QoL could not be ascertained. Second, since we used convenience and snowball sampling to recruit the participant centers, the personal biases of professionals may affect the process, although each center was instructed to select random participants. This procedure limits the generalizability of the findings to a larger population. Third, it would have been wise to use an objective rapid test to determine participant's functioning and application of evaluation tests. Leaving this decision in the hands of professionals introduces a good amount of subjectivity, even though the research team strictly controlled it and the professionals acted on clinical judgment based on their knowledge of individuals with ABI and their clinical history. Finally, although the assessment of participation in rehabilitation activities is an important strength of this study, it is necessary to obtain more information about this variable. It is difficult to compare the activities of different communities because of wide differences in the type of care that individuals with ABI receive in various settings.

Future research should aim to examine longitudinal changes in QoL and establish causal connections between predictive factors and QoL. It would also be extremely useful to further examine participation in rehabilitation activities within this population, translate the CAVIDACE scale into other languages, and validate it in other cultures to further enhance its utility.

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APPENDIX A. CAVIDACE SCALE

<u>Proxy version</u>	<u>Self-report version</u>
<p style="text-align: center;">EMOTIONAL WELL-BEING</p> <ol style="list-style-type: none"> 1. He/she enjoys the things he/she does 2. He/she is aware of and understands his/her disease 3. He/she presents signs of depression (e.g. insomnia, hypersomnia, tiredness, weeping, etc.) 4. He/she has no enthusiasm for anything 5. He/she is angry, aggressive or irritable 6. He/she has behavioural problems 7. He/she shows emotions/feelings adequate and proportionate to the time and situation 8. He/she requires professional help (e.g. psychological, psychiatric, pharmacological, etc.) due to signs and symptoms of emotional disorders 	<ol style="list-style-type: none"> 1. I enjoy the things I do 2. I present signs of depression (e.g. insomnia, hypersomnia, tiredness, weeping, etc.) 3. I have no enthusiasm for anything 4. I am angry, aggressive or irritable 5. I require professional help (e.g. psychological, psychiatric, pharmacological, etc.) due to signs and symptoms of emotional disorders
<p style="text-align: center;">INTERPERSONAL RELATIONSHIPS</p> <ol style="list-style-type: none"> 9. He/she has the relationship he/she wishes to have with his/her loved ones 10. He/she enjoys the company of other people (e.g. friends, family environment, etc.) 11. Specific measures are taken to maintain and extend his/her social networks 12. He/she shows affection towards others (e.g. partner, family, friends, etc.) 13. He/she maintains friendships from prior to the injury 14. He/she has friends with whom he/she frequently relates 15. He/she enjoys leisure time with his/her friends 16. His/her relationship with his/her loved ones has been worse since the injury 	<ol style="list-style-type: none"> 6. I have the relationship I wish to have with my loved ones 7. I enjoy the company of other people (e.g. friends, family environment, etc.) 8. I maintain friendships from prior to the injury 9. I have friends with whom I frequently relate 10. I enjoy leisure time with my friends
<p style="text-align: center;">MATERIAL WELL-BEING</p> <ol style="list-style-type: none"> 17. The place where he/she lives is adapted to his/her needs 18. Specific measures are taken to adapt the environment where he/she lives to his/her desires and preferences 19. He/she has access to new technologies (e.g. Internet, mobile phone, etc.) 20. He/she has access to the information he/she is interested in (e.g. newspaper, television, internet, magazines, etc.) 21. He/she has his/her own materials for entertainment (e.g. magazines, music, television, games, etc.) 22. His/her personal stuff is replaced or fixed when it deteriorated or get damaged 23. He/she has the services and support he/she needs. 24. He/she has the personal support products he/she needs 	<ol style="list-style-type: none"> 11. Specific measures are taken to adapt the environment where I live to my desires and preferences 12. I have access to new technologies (e.g. Internet, mobile phone, etc.) 13. I have access to the information I am interested in (e.g. newspaper, television, internet, magazines, etc.) 14. I have my own materials for entertainment (e.g. magazines, music, television, games, etc.) 15. My personal stuff is replaced or fixed when it deteriorated or get damaged
<p style="text-align: center;">PERSONAL DEVELOPMENT</p> <ol style="list-style-type: none"> 25. He/she finds solutions to daily life activities (e.g. what to do when he/she loses his/her keys) 26. He/she has difficulty concentrating (e.g. when reading or following a conversation) 27. He/she has problems remembering everyday things (e.g. where he/she left something, the day of the week, appointments, etc.) 28. He/she can find his/her way around in unfamiliar environments 29. He/she has the possibility of learning what he/she is interested in 30. He/she performs domestic activities (e.g. cooking, laundry, shopping, cleaning, etc.) 31. People around him/her encourage his/her independence and personal autonomy. 32. He/she does things for him/herself that he/she is capable of doing 	<ol style="list-style-type: none"> 16. I find solutions to daily life activities (e.g. what to do when I lose my keys) 17. I can find my way around in unfamiliar environments 18. I have the possibility of learning what I am interested in 19. I perform domestic activities (e.g. cooking, laundry, shopping, cleaning, etc.) 20. I do things for myself that I am capable of doing

PHYSICAL WELL-BEING	
<p>33. His/her eating habits are healthy</p> <p>34. Specific measures are taken to ensure his/her food is safe (e.g. texture changes, use of thickeners, changes of posture, need for tube feeding, etc.)</p> <p>35. He/she watches his/her weight</p> <p>36. The person who provide the person with support have specific training on his/her specific health-related issues</p> <p>37. He/she performs activities and physical exercise appropriate to his/her characteristics and needs</p> <p>38. Specific measures related his/her mobility are followed to enhance his/her independence</p> <p>39. He/she has adequate hygiene (e.g. teeth, hair, nails, body, etc.) and personal image routines (e.g. age-adequate, clothing style, situation-adequate clothing, etc.)</p> <p>40. His/her rhythms and quality of sleep are adequate</p>	<p>21. My eating habits are healthy</p> <p>22. Specific measures are taken to ensure my food is safe (e.g. texture changes, use of thickeners, changes of posture, need for tube feeding, etc.)</p> <p>23. I watch my weight</p> <p>24. I perform activities and physical exercise appropriate to my characteristics and needs</p> <p>25. Specific measures related my mobility are followed to enhance my independence</p>
SELF-DETERMINATION	
<p>41. Other people choose the activities he/she does in his/her free time</p> <p>42. He/she chooses the food or part of the food when there is a choice of starter, main course and dessert</p> <p>43. He/she takes part in decisions concerning his/her rehabilitation and treatment</p> <p>44. Other people decide on the clothes he/she wears each day</p> <p>45. Other people decide about his/her personal life</p> <p>46. He/she argues for his ideas, opinions, beliefs, and values</p> <p>47. He/she organises his/her own life</p> <p>48. He/she can invite the people he/she wishes into his/her personal space (e.g. professionals, relatives, friends, colleagues, etc.)</p>	<p>26. Other people choose the activities I do in my free time</p> <p>27. I take part in decisions concerning my rehabilitation and treatment</p> <p>28. Other people decide on the clothes I wear each day</p> <p>29. Other people decide about my personal life</p> <p>30. I organise my own life</p>
SOCIAL INCLUSION	
<p>49. He/she enjoys vacationing in inclusive environments (e.g. hotel, park, country house, beach, mountains, spa, theme parks, etc.)</p> <p>50. He/she performs activities with people who are not disabled</p> <p>51. He/she uses community environments (e.g. restaurants, cafes, libraries, swimming pools, cinemas, parks and beaches, etc.)</p> <p>52. He/she takes part in inclusive activities appropriate to his/her physical and mental conditions</p> <p>53. He/she has opportunities to discover environments other than the place where he/she lives (e.g. travelling, day trips, tours, etc.)</p> <p>54. He/she takes part in social and leisure activities (e.g. sport, hobbies, parties, etc.)</p> <p>55. He/she takes part in inclusive activities he/she is interested in</p> <p>56. He/she has access to public services in his/her community (e.g. bookshops, health centre, city council, etc.)</p>	<p>31. I use community environments (e.g. restaurants, cafes, libraries, swimming pools, cinemas, parks and beaches, etc.)</p> <p>32. I take part in inclusive activities appropriate to my physical and mental conditions</p> <p>33. I have opportunities to discover environments other than the place where I live (e.g. travelling, day trips, tours, etc.)</p> <p>34. I take part in social and leisure activities (e.g. sport, hobbies, parties, etc.)</p> <p>35. I take part in inclusive activities I am interested in</p>
RIGHTS	
<p>57. People around him/her treat him/her with respect (e.g. they speak to him/her in an appropriate tone, do not infantilise him/her, use positive terms, avoid negative comments in public, avoid speaking about the person as if he/she were not there, etc.)</p> <p>58. The people who provide him/her with support have specific training on ethics and respect for disabled people's rights.</p> <p>59. He/she participates in the development of his/her individual support plan</p> <p>60. The people who live with him/her disrespect his/her privacy (e.g. they read his/her correspondence, enter without knocking, etc.)</p> <p>61. He/she has a place where he/she can be alone if he/she wishes</p> <p>62. Specific measures are taken to respect his/her privacy (e.g. during personal care and hygiene, in relation to his/her sexuality, confidential information, etc.)</p> <p>63. He/she is provided with information about resources, support, rights, and obligations at the centre he/she attends</p> <p>64. His/her dignity is respected at the place where he/she lives (e.g. privacy, expression, no victimisation, etc.)</p>	<p>36. People around me treat me with respect (e.g. they speak to me in an appropriate tone, do not infantilise me, use positive terms, avoid negative comments in public, avoid speaking about the person as if I was not there, etc.)</p> <p>37. I take part in the development of my individual support plan</p> <p>38. Specific measures are taken to respect my privacy (e.g. during personal care and hygiene, in relation to my sexuality, confidential information, etc.)</p> <p>39. I am provided with information about resources, support, rights, and obligations at the centre I attend</p> <p>40. My dignity is respected at the place where I live (e.g. privacy, expression, no victimisation, etc.)</p>